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Abstract

Nutrition can affect bull fertility. Omega-3 fatty acids such as α linolenic, eicosapentaenoic, and docosahexaenoic acids can affect motility and morphology of sperm. Flaxseed is an excellent source of α linolenic acid and has been shown to increase tissue concentrations of both α linolenic acid and eicosapentaenoic acid, which are involved in synthesis of important reproductive hormones. Flax can be difficult to transport, process, and store, but the FlaxLic block (New Generation Feeds, Belle Fourche, SD) is stable and easy to handle, contains high levels of omega-3 fatty acids, and may be a useful supplement for developing beef bulls. In a previous study at Kansas State University, feeding FlaxLic blocks to developing bulls for 61 days prior to breeding soundness examinations increased rate of gain and percentages of motile and normal sperm. The FlaxLic block is a high-density, low-moisture product that resists heat and humidity. Blocks of this type typically are made with molasses. One of our study objectives was to determine whether corn steep liquor, when combined with molasses and subjected to high process temperatures (248°F to 284°F), could partially substitute for molasses with no significant change in block integrity or animal performance.

Keywords

Cattlemen's Day, 2010; Kansas Agricultural Experiment Station contribution; no. 10-170-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1029; Beef Cattle Research, 2010 is known as Cattlemen's Day, 2010; Beef; FlaxLic; Growth; Performance

FlaxLic Supplementation Improves Growth Performance of Angus Bulls

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Introduction

Nutrition can affect bull fertility. Omega-3 fatty acids such as alpha linolenic, eicosapentaenoic, and docosahexaenoic acids can affect motility and morphology of sperm. Flaxseed is an excellent source of alpha linolenic acid and has been shown to increase tissue concentrations of both alpha linolenic acid and eicosapentaenoic acid, which are involved in synthesis of important reproductive hormones. Flax can be difficult to transport, process, and store, but the FlaxLic block (New Generation Feeds, Belle Fourche, SD) is stable and easy to handle, contains high levels of omega-3 fatty acids, and may be a useful supplement for developing beef bulls. In a previous study at Kansas State University, feeding FlaxLic blocks to developing bulls for 61 days prior to breeding soundness examinations increased rate of gain and percentages of motile and normal sperm.

The FlaxLic block is a high-density, low-moisture product that resists heat and humidity. Blocks of this type typically are made with molasses. One of our study objectives was to determine whether corn steep liquor, when combined with molasses and subjected to high process temperatures (248°F to 284°F), could partially substitute for molasses with no significant change in block integrity or animal performance.

Experimental Procedures

Yearling Angus bulls (n = 120; initial body weight = 1,115 lb) were assigned randomly to three treatment groups: control (forage-based diet), FlaxLic (control diet with free access to FlaxLic), and corn steep block (control diet with free access to an alternative block formulation in which a portion of the molasses was replaced by corn steep liquor).

The control diet consisted of 61% chopped hay, 26% corn silage, 9% wheat middlings, and 3% supplement on a dry matter basis. Bulls were fed free choice for 70 days. Daily feed consumption was monitored using the GrowSafe electronic monitoring system (GrowSafe Systems, Ltd., Airdrie, Alberta, Canada). The 60-lb supplement blocks for the FlaxLic and corn steep block treatments were placed in GrowSafe feeders for the designated pen. One pen of 40 bulls was used for each treatment.

Identification number, treatment allocation, initial body weight, and final body weight for each bull were recorded. Feed and block consumption were also recorded. Blood samples were drawn from all bulls on day 14 of the trial and again at the end of the trial. Blood serum was analyzed via gas chromatography to determine long-chain fatty acid concentrations.

A veterinarian performed breeding soundness examinations on a randomly selected population of bulls from each treatment at the beginning and end of the trial. Semen

samples were evaluated for sperm motility, sperm morphology, and long-chain fatty acid composition.

Results and Discussion

Supplementation with FlaxLic and the corn steep block increased serum concentrations of alpha linolenic acid (Table 1). Concentrations of alpha linolenic acid and arachidonic acid in semen were decreased ($P<0.05$) by FlaxLic but not by the corn steep block compared with the control (Table 1). Excess arachidonic acid can lead to oxidation and loss of sperm motility. We speculated that the observed shift in fatty acid concentration may have improved semen quality. Conversely, supplementation with FlaxLic and the corn steep block had no effect on the percentages of normal or motile sperm compared with the control diet (Table 2). Similarly, breeding soundness examination results were similar among treatment groups.

The FlaxLic treatment increased ($P<0.05$) average daily gain (Table 3) and improved ($P<0.05$) gain efficiency compared with the control and corn steep block treatments. Differences in performance between the block formulations indicated that certain ingredients, such as corn steep liquor, may be unsuitable for use in processes that use high temperatures, such as block manufacturing.

Implications

Feeding FlaxLic or the corn steep block did not alter breeding soundness in spite of increased amounts of key fatty acids in semen. However, FlaxLic increased growth performance and efficiency. Substituting 15% corn steep liquor for molasses had a negative effect on nutritional value of the corn steep block. We speculated that corn steep liquor proteins may have been damaged when combined with sugars and subjected to high processing temperatures.

Table 1. Serum and semen fatty acid concentrations in yearling Angus bulls fed a forage-based diet (Control) and supplemented with FlaxLic or a corn steep liquor block

Fatty acid, µg/g	Control	FlaxLic	Corn steep block	SEM
Blood serum fatty acids				
Linoleic acid (omega-6)	479.7	486.7	455.1	17.52
Alpha linolenic acid (omega-3)	126.4[a]	146.8[b]	140.3[ab]	5.1
Arachidonic acid (omega-6)	4.75	4.86	4.55	0.61
Eicosapentaenoic acid (omega-3)	5.69	6.39	7.14	0.66
Docosahexaenoic acid (omega-3)	5.69	5.54	5.02	0.45
Total fatty acids	1237	1276	1212	37
Semen fatty acids				
Linoleic acid (omega-6)	28.48	37.25	34.62	3.68
Linolenic acid (omega-3)	11.93[a]	7.28[b]	8.86[ab]	1.08
Arachidonic acid (omega-6)	4.20[a]	2.36[b]	3.08[ab]	0.52
Eicosapentaenoic acid (omega-3)	1.94	2.08	2.13	0.52
Docosahexaenoic acid (omega-3)	213.4	163.1	181.2	22.9
Total fatty acids	489.6	419.9	437.8	39.6

Means in a row with common superscript letters are not different (P>0.05).

Table 2. Breeding soundness and semen attributes of yearling Angus bulls fed a forage-based diet (Control) and supplemented with FlaxLic or a corn steep liquor block

Item	Control	FlaxLic	Corn steep block	SEM
Sperm motility, %	51.3	51.9	50.5	2.16
Normal sperm, %	79.7	80.7	79.5	1.15

Table 3. Performance data of yearling Angus bulls fed a forage-based diet (Control) and supplemented with FlaxLic or a corn steep liquor block

Item	Control	FlaxLic	Corn steep block	SEM
Dry matter intake, lb	26.8[a]	25.7[b]	25.52[b]	0.17
Daily gain, lb	2.93[a]	3.27[b]	2.73[a]	0.06
Feed:gain	9.16[a]	7.91[b]	9.14[a]	0.22

Means in a row with common superscript letters are not different (P>0.05).